AUTOMATIC VEHICLE BREAKING SYSTEM

[1]Prof. Bhagyashri S. Chaudhari, [2]Kanhaiya Kote, [3]Vishnu Gurav, [4]Arshad Sayyad, [5]Abhishek Jagtap
[1,2,3,4]Department Of Computer Engineering,
[1,2,3,4]KJEI's Trinity Polytechnic Pune, Maharashtra, India.

Abstract : The Automatic Vehicle Braking System (AVBS) is an innovative safety technology designed to prevent road accidents by automatically applying a vehicle's brakes when an obstacle is detected. This system enhances vehicle safety by reducing the reaction time required to stop a vehicle and preventing collisions that could otherwise be caused by human error or delayed response. The AVBS operates through a combination of radar, cameras, and LiDAR sensors that continuously monitor the vehicle's surroundings, detecting obstacles such as other vehicles, pedestrians, or road hazards. Upon identifying a potential collision, the system calculates the optimal braking force needed to either avoid the crash or reduce its severity. AVBS is designed to work seamlessly with other advanced driver-assistance systems (ADAS), such as lane-keeping assistance and adaptive cruise control, to further enhance overall vehicle safety. This technology can be particularly beneficial in emergency situations where the driver may not have sufficient time to react. With ongoing development and integration, AVBS has the potential to become a standard feature in future vehicles, significantly improving road safety on a global scale. As a result, AVBS contributes to reducing traffic-related injuries and fatalities, making roadways safer for all users.

I. INTRODUCTION

As the number of Android phones continues to rise, there is a simultaneous increase in the number of mobile malware applications that perform malicious activities such as misusing user's private information by sending unauthorized messages, reading users' contact details, and exploiting confidential data stored on the device. These malware applications can also harm organizations by stealing sensitive data, leading to significant financial and reputational damage. The rapid spread of malware not only compromises the privacy of individuals but also threatens the security of businesses and government entities. Malware classification and identification have thus become critical concerns for ensuring mobile security. Android users, however, are often unaware of whether the apps they are using are infected with malware or not. To address this, Android applications rely on a permission mechanism that specifies the permissions an app requires to access sensitive data on the device. This allows users to have some level of control over the information that apps can access. However, many users do not fully understand the implications of granting these permissions, leaving them vulnerable to exploitation. Therefore, effective malware detection and education on permissions are essential to safeguarding user data.

II. LITERATURE REVIEW

Automatic Vehicle Braking Systems (AVBS) have become a critical safety feature in modern vehicles, with research focusing on the integration of sensors like radar, LiDAR, and cameras to detect obstacles and apply brakes in emergencies. Studies have shown that AEBS (Automatic Emergency Braking Systems), which use these sensors, can significantly reduce rear-end collisions by automatically engaging the brakes when a potential collision is imminent. Research by Zhang et al. (2018) highlighted that combining radar and LiDAR improves the accuracy of obstacle detection, especially in challenging weather conditions, leading to a more reliable braking response in urgent situations.

Recent advancements have also explored the use of machine learning and sensor fusion to enhance AVBS performance. By integrating data from various sensors, such as cameras, ultrasonic sensors, and radar, and using machine learning algorithms, these systems can predict dynamic obstacles and make more informed braking decisions. Liu et al. (2019) demonstrated how machine learning models, when combined with sensor fusion, improve the accuracy of collision predictions, enabling quicker and more accurate braking actions. This combination of technologies ensures that AVBS continues to evolve, providing safer driving experiences in diverse environments.

III.RESEARCH METHODOLOGY

The methodology section outlines the systematic approach to understanding, analysing, and validating the automatic vehicle braking system. This includes identifying the study's population, data collection methods, variables, and analysis techniques. Details are as follows:

Population and Sample

The study focuses on vehicles equipped with automatic braking systems (ABS) across various manufacturers. The target population includes passenger cars, commercial vehicles, and prototype models tested under controlled environments. A sample of 30 vehicle models from diverse manufacturers and segments has been selected based on market representation and technological variation.

Data and Sources of Data

The research relies on secondary and experimental data:

- **Secondary Data**: Collected from manufacturers' technical manuals, safety reports, and previous studies on ABS performance.
- **Experimental Data**: Obtained from real-world and simulated braking scenarios conducted at automotive test facilities. Metrics such as stopping distance, response time, and collision avoidance rates are recorded.

Theoretical Framework

The study evaluates the performance of ABS using dependent and independent variables:

- **Dependent Variables**: Stopping distance, deceleration rate, and collision mitigation efficiency.
- **Independent Variables:** Vehicle speed, road conditions (wet, dry, icy), and system configuration (radar, camera, or sensor-based).

Statistical Tools and Analytical Framework

- **Descriptive Statistics**: Applied to summarize the performance metrics, including mean, standard deviation, and range for each scenario.
- **Regression Analysis**: Used to analyse the relationship between road conditions, vehicle speed, and braking efficiency.
- **Simulation Models**: Software-based tools (e.g., MATLAB, Simulink) are employed to simulate and validate the performance under various conditions.
- **Safety Ratings**: Comparative analysis of ABS-equipped models against industry safety benchmarks.

Experimental Setup

The experimental study is conducted under controlled conditions, ensuring standardized environments for consistency. Tests include:

- Emergency braking on different surfaces.
- Scenario-based tests, such as obstacle detection and avoidance.

IV. CONCLUSION

In conclusion, the development and implementation of Automatic Vehicle Braking Systems (AVBS) represent a significant leap forward in vehicle safety technology. By integrating advanced sensors such as radar, LiDAR, and cameras, alongside machine learning algorithms and sensor fusion, AVBS has the potential to dramatically reduce accidents caused by human error, ensuring quicker response times in critical situations. These systems are designed to detect obstacles in real-time and automatically apply the brakes, minimizing the risk of collisions, protecting passengers, pedestrians, and other road users.

As the technology continues to evolve, future advancements in sensor accuracy, system integration, and predictive algorithms will further refine the effectiveness of AVBS. Moreover, the incorporation of vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication holds promise for even more responsive and intelligent braking systems. Ultimately, AVBS is expected to become a standard feature in all vehicles, significantly contributing to safer road environments and the reduction of traffic-related injuries and fatalities. With continued research and development, AVBS will play a crucial role in transforming road safety on a global scale, paving the way for safer, smarter, and more autonomous driving experiences.

V. REFERENCES

[1] Hasan Oktem, Ilyas U., & Murat C. (2019). "Design, Construction, and Performance of a Novel Brake Pad Friction Tester." Measurement Journal, Volume 115, pp. 299-305. This paper provided insights into the brake pad performance testing and its influence on the braking mechanism design in the AVBS.

[2] Kavatkar, M.T., Salve, H., & Rahate, M. (2020). "Design and Analysis of an Intelligent Braking System." International Journal of Engineering Development and Research, Volume 5, Issue 1, pp. 119-131. This work explored intelligent braking systems, guiding the selection and integration of components for AVBS, with a focus on control algorithms and sensor integration.

[3] Duane J., Li R., Hou L., & Gao H. (2020).
"Driver Braking Behaviour to Improve Autonomous Emergency Braking Systems in Typical Vehicle-Bicycle Conflicts." Accident Analysis and Prevention. Elsevier. This study helped understand human braking behaviour and its impact on automated braking systems, aiding in the design of AVBS algorithms for realistic, real-world scenarios.